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CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that the annexed is a true copy of the Provisional Specification as filed on 28 July 1998 with an application for Letters Patent number 331192 made by Goatley, Ernest Paul.

Dated 03 August 1999.

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331192

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PROVISIONAL SPECIFICATION

GEARBOX ADAPTOR

I, ERNEST PAUL GOATLEY, 166 Clyde Street, Balclutha, New Zealand, a New Zealand citizen, do hereby declare this invention to be described in the following statement:

The present invention relates to a gearbox adapter for insertion into a standard gearbox to convert a standard gearbox to a sequential gearbox. As used herein, the term 'standard gearbox' means a gearbox in which, to change from one gear to another, the gear-lever must be moved in a direction which depends upon which gear is being moved out of and which gear is being moved into. The term 'sequential gearbox' means a gearbox in which to change up a gear, the gear-lever always is moved in one direction, and to change down a gear, the gear-lever always is moved in the opposite direction.

Sequential gearboxes are especially useful in racing and rally cars, where rapid gear changes without looking at the gear-lever are essential.

Purpose-built sequential gear boxes are known, but are much more expensive than standard gearboxes. Further, known sequential gearboxes provide a comparatively slow gear-change:- the engine must be unloaded to change gear, and the car therefore decelerates for the period of the gear change, (typically about 0.1 sec.), resulting in a loss of speed of the order of 3.5 kph.

It is therefore an object of the present invention to provide a gearbox adapter which is capable of insertion into a standard gearbox to convert it to a sequential gearbox, to provide a sequential gearbox in which gear changes can be made rapidly (typically 0.02 sec.) and at full throttle, so that the car does not lose speed during a gear change.

The present invention provides a gearbox adapter including: a central hub adapted to be splined to a gear shaft for rotation therewith; two annular pistons,

one mounted on each side of the hub, so as to surround said shaft; a fluid passage between the exterior of the hub and the face of each piston adjacent the hub; an annular composite clutch pack concentric with each piston and located adjacent that face of said piston remote from said hub; part of each clutch pack being splined to said hub and part being adapted to be splined to a gear locatable on said gear shaft adjacent said hub.

It is known to provide a hydraulically operated piston, clutch, and hub system for a gearbox, but known systems provide a separate hub, clutch and piston for each gear, with hydraulic fluid supplied to the system through the shaft. This arrangement cannot be used to adapt existing gearboxes, since in existing standard gearboxes, the shafts are not provided with hydraulic passages.

It is a further object of the present invention to provide a gearbox adapter which can be used with any selected pair of existing gears and can be installed simply by removing the existing synchro-hubs and cones and replacing them with a hub in accordance with the present invention.

Preferably, all of the gears of a standard gearbox are adapted to the present system, but it is also possible to adapt only some of the gears of a standard gearbox, and leave the remaining gear or gears to be operated in known manner.

By way of example, only, a preferred embodiment of the present invention is described in detail, with reference to the accompanying drawings, in which:-

Fig. 1 is a schematic sectional view through part of a gearbox in accordance with the present invention;

Fig. 2a and 2b are plan views of two clutch components; and

Fig. 3 is a block diagram showing the electronic controls.

Referring to Figs. 1 and 2 of the drawings, a gearbox adapter 2 comprises a central splined shaft 3 upon which are mounted a hub 4, a first gear 5, a second gear 6, two pistons 7, 8 and two clutch packs 9, 10.

The shaft 3 is the main shaft of a standard gearbox and is externally splined, and driven in known manner.

The first and second gears 5, 6 are gears of known type, forming part of a standard gearbox and are freely rotatable relative to the shaft 3, but are fixed in position relative to the length of the shaft 3.

The hub 4 has a central portion 4a concentric with the shaft 3, with a rim 11, around the periphery of said central portion. The rim 11, is of greater width than the central portion 4a.

The extension of the rim beyond the central portion of the hub provides two annular recesses in which the pistons 7, 8 and the clutch packs 9, 10 are mounted, concentric with the shaft 3.

Each piston 7, 8, is annular and is mounted adjacent one side of the central portion 4a of the hub, spaced from the hub by a passage 13, 14 respectively. The passages 13, 14 are connected to corresponding passages 15, 16 in the hub 4, through which hydraulic fluid can be supplied to the passages 13, 14, as hereinafter described.

A pair of annular seals 17, 18, 19, 20 respectively, seal the gaps between the edges of the pistons 7, 8 and the adjacent walls of the gears and the hub respectively.

A further annular seal 21 extends around the outer wall of the rim between the passages 15 and 16. The seal 21 extends between the outer wall of the rim and a casing 22 which surrounds the hub 4 and is located on the hub by circlips 23. Bushes 24 are located between the opposed faces of the hub 4 and casing 22, to permit the casing 22, to remain stationary while the hub 4 rotates.

Fluid passages 15a, 16a, corresponding to passages 15 and 16 are formed in the casing 22, for supply of hydraulic fluid.

Each clutch pack 9, 10 comprises a series of annular steel plates 25 interleaved alternately with a series of annular bronze plates 26. Each steel plate 25 is formed with four equidistantly-spaced dogs 27 which are dimensioned and arranged to engage corresponding grooves (not shown) in the adjacent face of the rim 11, so that the steel plates rotate with the hub but can move relative to the hub in the directions indicated by arrows A and B.

Each bronze plate 26 is formed with splines 28 around its inner periphery. The splines 28 are received in corresponding grooves (not shown) on the adjacent portions 30 of the gears 5, 6, so that the bronze plates 26 rotate with the gears 5, 6, but can move relative to the gears in the directions of arrows A and B.

To convert the whole of a standard gearbox using the present invention, all of the synchro-hubs and cones are removed from the standard box, and a

gearbox adapter as described above is fitted between each pair of gears: first/second and third/fourth. For reverse gear, the standard clutch system generally is retained, since it is undesirable in a racing car to be able to select reverse gear easily. If the standard gearbox has an odd number of forward gears, then either the standard clutch system is used for the 'odd' gear or the present adapter is modified to act for a single gear.

The above-described system can be controlled by any suitable control, but preferably is controlled by an electronic/hydraulic system as shown in Fig. 3.

The control system includes an electronic joystick (not shown) which is connected to a first and a second micro-switch 32, 33 such that when the joystick is moved in one direction, the first micro-switch 32 is closed, and when the joystick is moved in the opposite direction, the second micro-switch 33 is closed. The micro-switches 32, 33 are connected to a series of solenoid valves 1', 2', 3', 4' each controlling the flow of hydraulic fluid to one section of one of the hubs 3, via a series of relays 1", 2", 3", 4" and a sequencing arrangement (e.g. a control integrated circuit) which provide that each time the first micro-switch 32 is closed, the next solenoid in the sequence 1', 2', 3', 4' is opened and each time the second micro-switch is closed, the next solenoid in the sequence 4',3', 2', 1' is opened.

When the first solenoid valve is opened, hydraulic fluid is supplied through that valve to one of the passages 16a and hence to the associated passages 16 and 14, to push the piston 8 in the direction of arrow B. The piston 8 contacts the plates of the clutch pack 10 and pushes them in the same direction, urging

the plates of the clutch pack into contact with each other and with the face 31 of the first gear. Since the plates 25 of the clutch pack are splined to the hub 4 and the plates 26 to the gear 5, and the hub 4 is splined to the shaft 3, pushing the plates 25, 26 together into driving contact with each other brings the first gear 5 into driving engagement with the shaft 3, and the gear rotates with the shaft, so that the vehicle drives in first gear. When the first solenoid valve is closed, the rotation of the gearbox tends to fling fluid out of the passages 14/16/16a, drawing the piston 8 back to the position of Fig. 1 and disengaging first gear.

When the second solenoid valve is opened, fluid is supplied to passages 15a/15 and 13 and the second gear is engaged in the same manner as the first.

Thus, every time the joystick is moved in said one direction, the solenoid valve (if any) which is open, is closed, and the next solenoid valve in the sequence 1', 2', 3', 4' is opened, to engage the next higher gear. Every time the joystick is moved in the opposite direction, the solenoid valve which was open is closed, and next solenoid valve in the sequence 4', 3', 2', 1' is opened to engage the next lower gear.

It is envisaged that the solenoid valves could be controlled automatically by a rev-counter, so that the gears are changed up or down automatically, depending upon the engine revs.

Although the present invention has been described specifically with reference to pairs of gears, it is envisaged that the invention could be adapted to operate single gears alone.

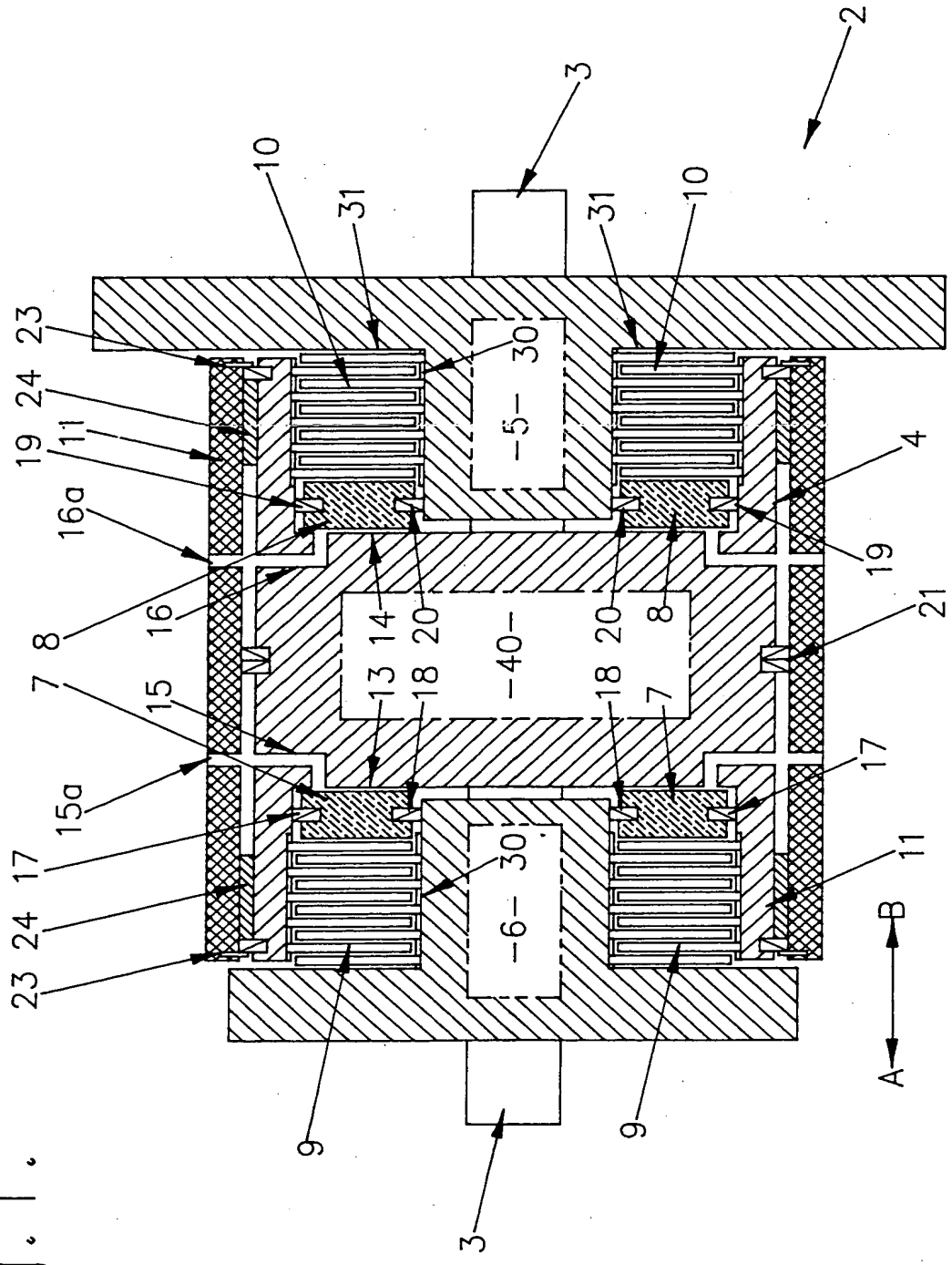
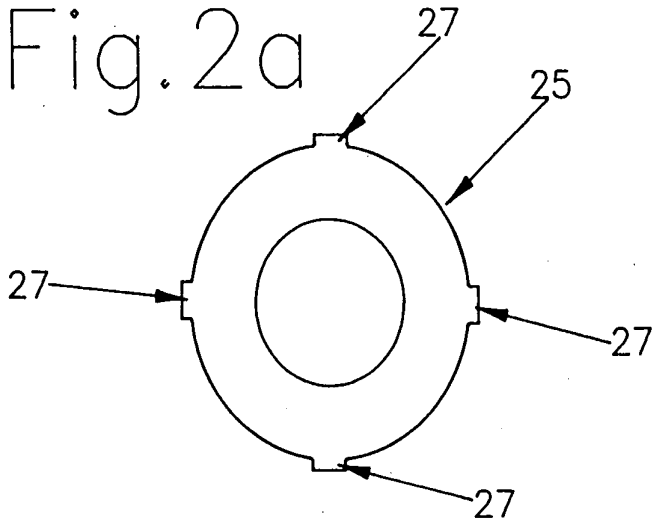


Fig. 1.

Fig.2a



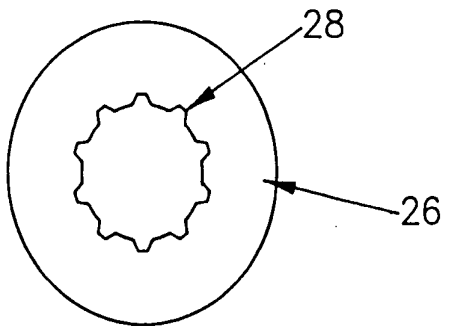


Fig.2b

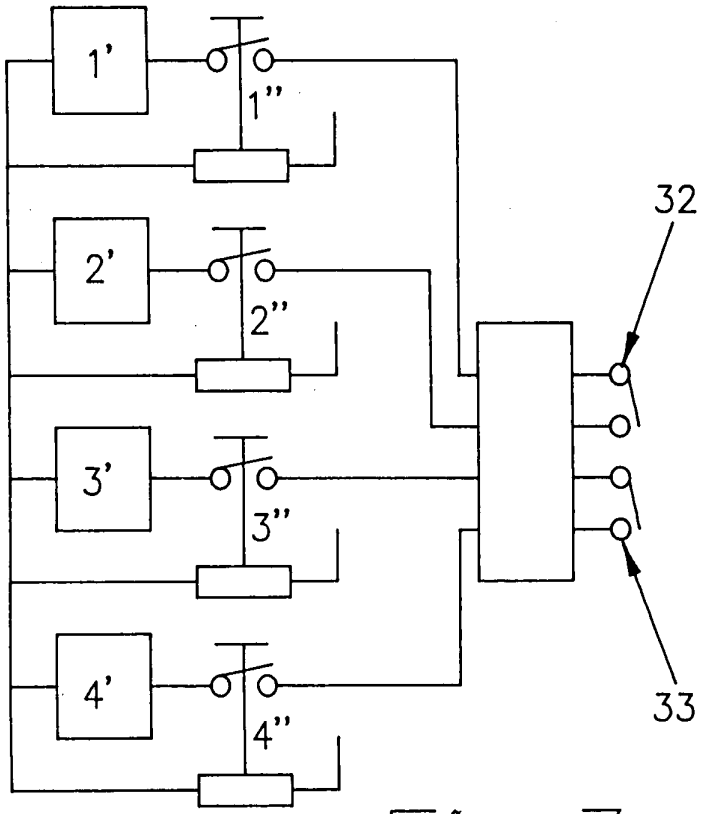


Fig.3.